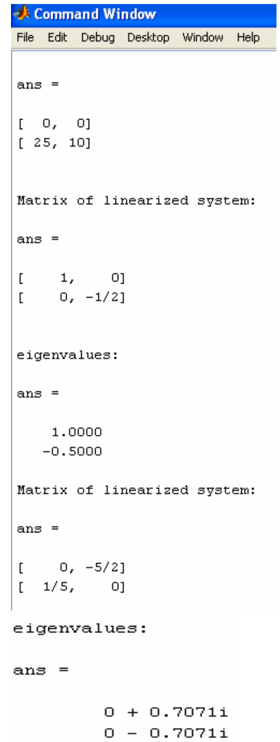
Stability analysis



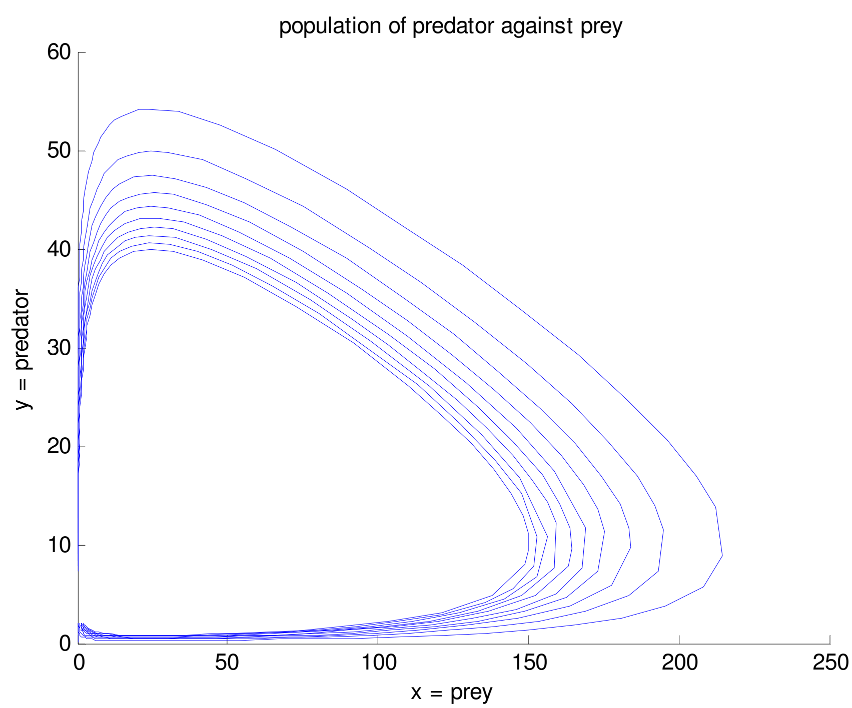
Method

1. Formulate the differential equations
2. Find out about the stationary point by setting the differential equations to 0.
3. Form Jacobian matrix using partial differentiation on differential equation
4. Substitute the stationary point value into the matrix and obtain its eigen value
5. Determine whether the stationary point is stable

Experiment

A matlab programme was developed to perform above functions, and it produces the stationary points, Jacobian matrix and eigen value as an output. (an analysis results for Exp 1 on the right)

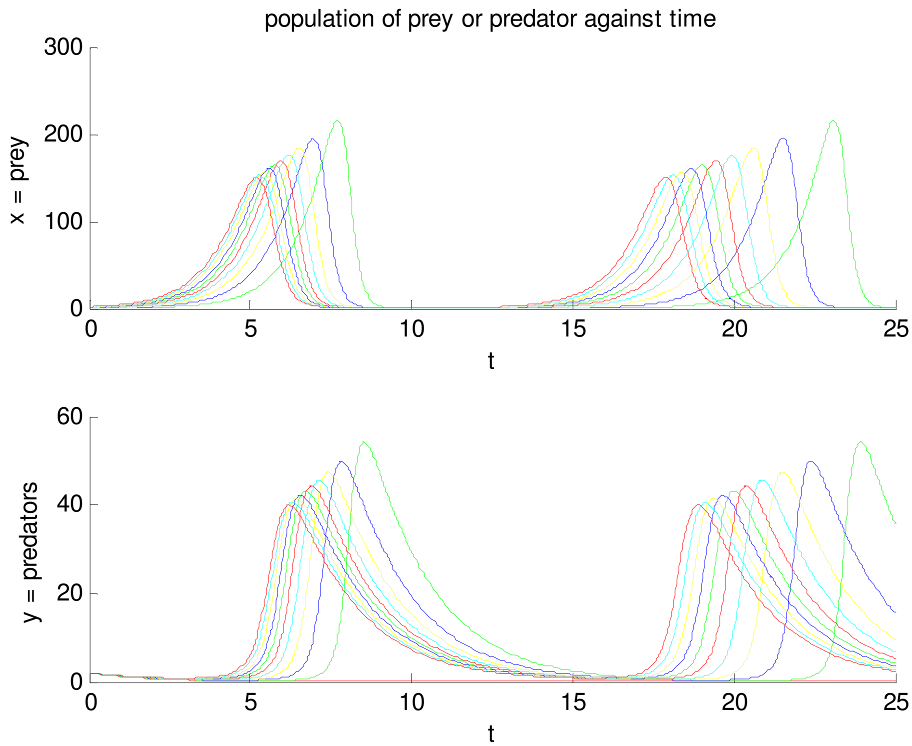
To visualize the effect of the stationary point, it is useful to have a graph of Y against X, such that we might be able to see a closed contour around the stationary points, or point to the stationary points. With the initial condition from Experiment 1, we have generated the following graph.



- There are two stationary point (0, 0) and (25, 10). They behave as it is expected, (0,0) is a unstable point, and (25,10) is a center.

- The different contour produced is by using different initial condition of (x, y)

To visualize how initial condition varies the output of population against time, we are using different colour to represent different initial conditions.



- From the graph above, we observed that the initial condition could vary the amplitude and the period of the oscillation, which requires us for further study as well.

Conclusion

With ready built matlab programme, we are able to analysis the stability of a given differential equation, and allow us to understand more about the system dynamics.